Water Tube BOILERS

THE McALEENAN CORPORATION

Pittsburgh *Penna.*

THE McALEENAN CORPORATION

WATER TUBE BOILERS

OFFICE AND WORKS
25TH AND RAILROAD STREETS

PITTSBURGH, PA.

GEO. R. McALEENAN, PRESIDENT
EDGAR R. CATE, VICE-PRESIDENT
W. W. JOHNSTON, TREASURER

March 28th, 1925.

Robb Eng. Works,
Amherst,
Nova Scotia, Canada.

ATT: MR. G. W. COLE, SECY.TREAS.

Gentlemen:-

Agreeable with your request of March 25th, we are sending you, under separate cover, a copy of our new catalogue. Much information in this booklet will be of interest to the engineering profession and we desire, particularly, to call your attention to the service our organization is prepared to render - we do not stop at the sale of a boiler; we handle the design of settings of all kinds and render field service for the most exacting requirements, thus putting all work under one responsibility from "design to a unit in operation."

The unique form of our Waste Heat Boiler will interest you - it departs from the usual, but is scientifically sound in principle.

We hope to have the opportunity of serving you.

Very truly yours,

THE MCALEENAN CORPORATION,

H. W. Cole

HWC:B

March 25/25.

McAleenan Corporation,
Pittsburg, Pa.

Gentlemen:

We note by the last number of Power House, Toronto, that you have recently issued a new catalogue describing your Water Tube Boilers.

We shall be very much pleased to receive a copy of this catalogue if you care to forward it to us.

Yours truly,

Secretary-Treasurer.

G.W.Cole-M.

McAleenan

Water Tube Boilers

CATALOG No. 4

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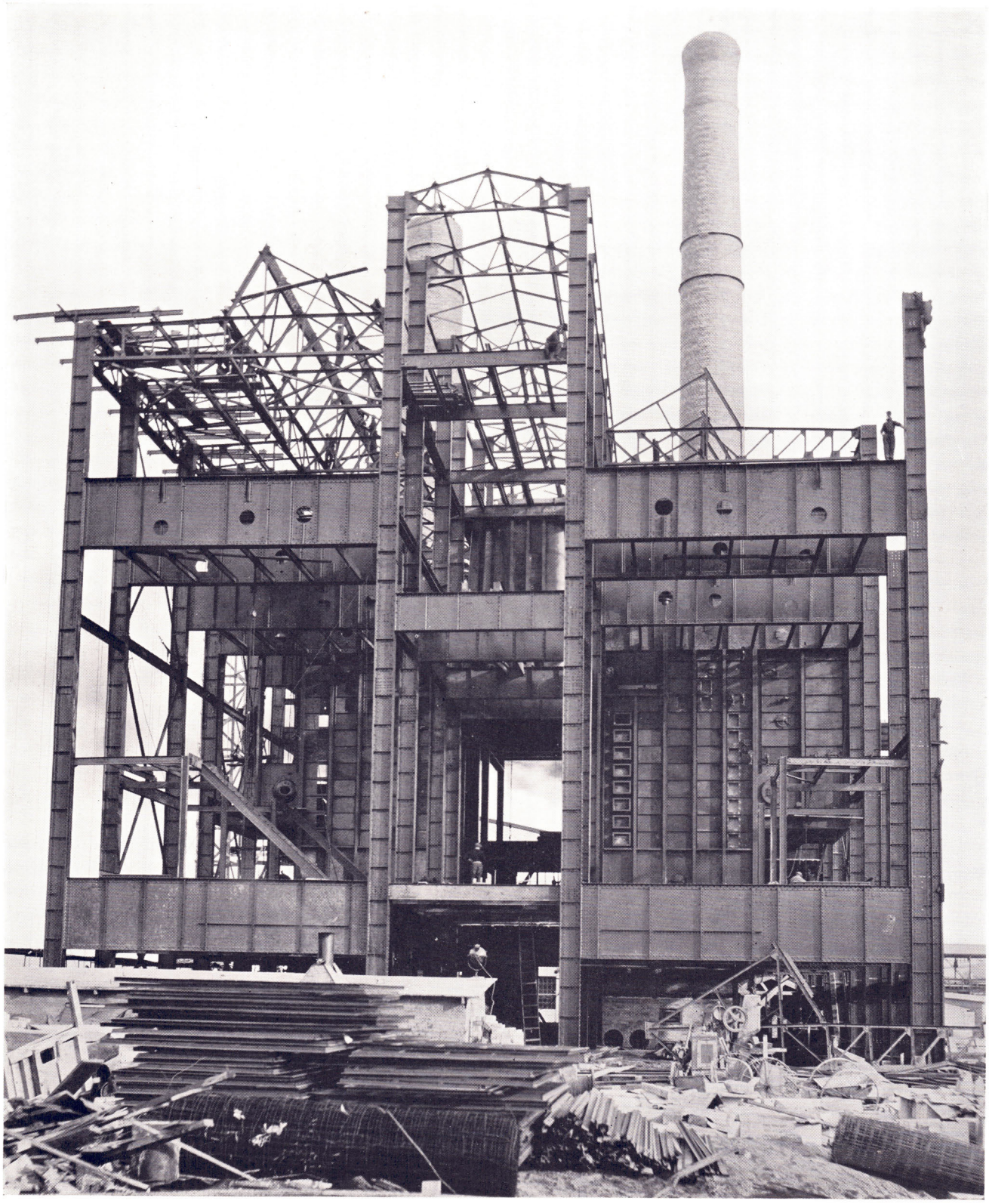
The McAleenan Corporation
Pittsburgh

PATENTS:—The equipment illustrated in this catalog is covered by patents issued or pending.

The McAleenan Corporation

PITTSBURGH, PA.



Large Industrial Plant showing McAleenan Inclined Type Boilers in course of construction

FOREWORD

THE following pages show the three types of boilers which have proved to be of essential value in steam generation. With much of the data shown, not only are the details of the boiler structure itself given, but the furnace design, upon which so many economies of operation depend, is also clearly indicated.

Service to be of any real value to boiler users must be based on an intimate knowledge of the vast amount of detail attendant upon the combination of the modern boiler and its present day furnace. The studies made by our engineers have made it possible for this company not only to furnish equipment covering this entire range of types and sizes, but also to co-ordinate all parts of the finished unit under one responsibility.

THE McALEENAN CORPORATION

INCLINED TYPE

THIS design is furnished with either a three-drum or four-drum cross section, but without water connecting tubes between the two main top drums. Water is fed to the top rear drum, and from there it must descend the entire length of the rear bank of tubes before entering the active circulation in the front portion of the boiler.

A sealing device, the McAleenan thermal seal, frequently is used to close the lower ends of the tubes in the rear bank against upward circulation of the water from the lower drum to the feed drum, and in such cases a true economizer effect is secured in the tubes connecting the feed and mud drums. Invariably, where this has been used, an appreciably lower outlet gas temperature has been obtained than in cases where the thermal seal has been omitted.

In many cases a fourth drum is supplied to act wholly as a steam drum. This drum is placed above the water line with drain tubes connecting either the front or rear top drums for the purpose of leading off any water which may carry over from the front relieving drum during periods of operation unfavorable for securing dry steam.

The tube nest is divided into three banks of tubes which can be baffled to secure three, four or five gas passes. In the larger units the tubes decrease in size from the front to the rear. Usually, those in the front bank are $3\frac{1}{4}''$ O.D.; those in the middle bank, $3''$; and those in the rear bank, $2\frac{1}{2}''$. This decrease allows a corresponding decrease in the drum ligament which, together with the integral economizer, effects a more efficient heat absorbing combination than is secured in the older arrangement of equal size tubes, equal ligaments, and free intermingling of water at steam temperature with the cooler feed water.

In addition to the features providing for efficient heat absorption and good quality of steam, a fundamental part of the design is accessibility to every interior portion of the boiler. It is almost needless to point out the necessity for maintaining clean surfaces and tight baffles, but it is logical to call attention to the care exercised to provide access to all parts of the structure to which the operator must give constant attention.

We manufacture boilers of this type in a wide range of cross sections, furnace widths, pressures and sizes, made necessary by the varying conditions surrounding each installation. Full consideration is given particularly to the method of firing, which so often is the determining factor in proportioning a boiler for any given amount of heating surface. One condition may warrant an exceptionally wide furnace, while in another case, governed perhaps by the use of pulverized fuel, a narrow furnace can be used, with a resulting saving in boiler room dimensions.

Any description of this type properly should call attention to the fact that this boiler excels in quick steaming, overload capacity, and reliability of performance. In the last analysis these three features, when combined with high operating efficiency and ability to produce dry steam, assure a thoroughly good boiler.

McAleenan Inclined Type Boiler partially tubed

HORIZONTAL TYPE

THE McAleenan horizontal boiler fulfills the requirements of safety, efficiency and capacity, dictated by modern practice, and at the same time, through the design of the component parts, permits of a flexibility in its arrangement, which meets widely varying conditions of fuel, methods of firing, and available space.

The boiler is made up of a series of vertical sections or units, each consisting of a number of tubes expanded at each end into sinuous steel headers, which in turn are connected with a cross drum. Each header accommodates two vertical rows of tubes so arranged in staggered relation to each other as to secure the most effective tube presentation to the gases in their passage through the boiler.

The tubes of three-inch diameter are inclined at an angle of fifteen degrees from the horizontal and are accessible for interior cleaning or replacement from either end through handholes (in the headers) which serve two tubes each. Obviously, the labor of taking off and replacing these double tube handhole covers is only one-half that encountered in cases where there is a cover for each tube.

The boiler is baffled vertically for three or four passes of the gases of combustion, with the passage areas properly proportioned to assure maximum heat absorption without excessive draft loss. As regularly installed, the baffles are of the monolithic type; but where preferred, they are made of suitable tile.

Drawings on pages 14 and 15 show two of the most popular forms of baffles for this type of boiler and also indicate the facility with which any desired superheater application may be made, i.e., between the first and second pass, the inter-deck type or the radiant superheater.

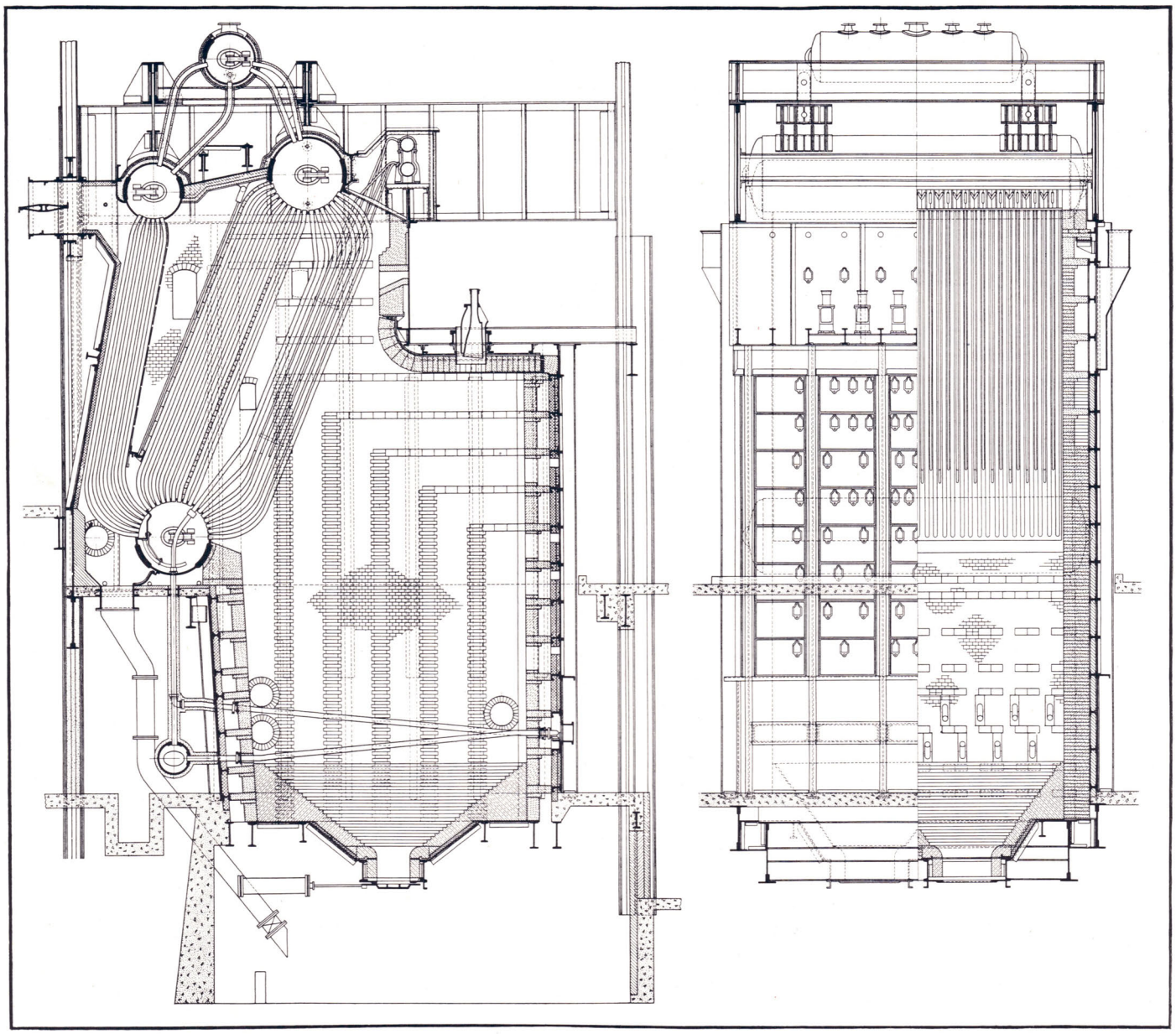
The feed water after being distributed throughout the length of the main drum, passes downward through the connecting tubes to the rear headers, and thence forward and upward through the tubes and front headers to the horizontal connecting tubes where the steam is liberated and led back into the drum. All the rear headers are connected with a mud drum which is fitted with flanges for blow-off connections and handholes for cleaning and access. The circulation is positive and unrestricted, affording little opportunity for depositing foreign matter carried in the water.

Such a circulation, together with the use of tubes which divide the water into small streams, accounts for one of the most desirable boiler characteristics,—rapid and flexible steaming. Another characteristic of a satisfactory boiler, good quality steam, is attained by use of the double system of horizontal tubes connecting the front headers with the cross drum, in which the steam is largely disengaged before it is delivered to the drum at or above the water level, over the entire width of the tube bank.

The support of the boiler is a structural frame so arranged that expansion and contraction do not affect the brick setting. Front and rear doors of ample size provide ready means for inspection of the headers, or work on them, and a number of doors in the setting give access for cleaning or inspection of the tubes and baffles.

The cost of maintenance is legitimately a matter of the utmost concern to any boiler purchaser. With this in view we have provided the most rugged construction throughout, the best of materials, careful attention to details and good workmanship. The double handhole openings furnish roomy space for work on the tubes and permit tube replacements to be made quickly and cheaply. Maintenance of the boiler itself is largely a question of tubes and tube cleaning, so the importance of the header and handhole design cannot be overlooked.

This boiler is built in units of from 150 Hp. to 2500 Hp. and for such working pressures as the service requires. Any given unit can be furnished to fit different space conditions by varying the number of sections, number of tubes high in a section, and the length of the tubes. This flexibility of assembly makes the boiler readily adaptable to different forms of furnaces and methods of firing without impairing its efficiency. Standard types of superheaters can be advantageously placed without any alteration in design or construction.



McAleenan Inclined Type Boiler combined with Pulverized Fuel Setting, Water Screen and Elesco Superheater
Stone and Webster, Designing and Constructing Plant Engineers

THE illustrations above show one of the most recent installations of the inclined boiler in combination with a pulverized fuel furnace. The boiler itself is specially designed for this method of firing, utilizing as its basic feature the fact that for such a furnace the designer is not limited to a width necessary to accommodate an adequate stoker. Such a condition permits a deeper cross section, longer gas travel and a more efficient grouping of the heating surfaces than can be obtained with boilers of this type for certain fixed furnace conditions.

The furnace is steel jacketed throughout and air cooled for the entire vertical height of the side and front walls. The air cooling feature is unique in that no air is taken from the boiler room, but is fed to the air duct registers through the ash pit tunnel. This avoids exhausting large volumes of air for combustion from the boiler room proper.

These boilers are equipped with superheaters

to supply 200° superheat, and with water screens as a preventive against slag formation in the ash pit. This type possesses such furnace volume and firing equipment that in actual operation it has developed 400% of normal boiler rating.

Some of the other interesting features of the unit are:

(a) The use of the thermal seal, which insures a temperature well under 500° in the outlet gases when operating at approximately double rating.

(b) The pin-connected type of suspension which permits perfect freedom for any expansion movement without torsional stress in the structure.

(c) A removable rear casing by means of which the entire rear end of the boiler may be thrown open.

(d) The exceptional economy of space for a boiler of this size.

(e) The details of the furnace structure itself, which provide an outside bolted casing, an almost complete insulation against heat radiation from the setting, and a fire brick construction which not only maintains the brick and tile in position, but affords necessary provision for otherwise destructive expansion movements.

(f) An arch design particularly adapted for use with pulverized fuel, wherein the refractory is countersunk to shield the burners.

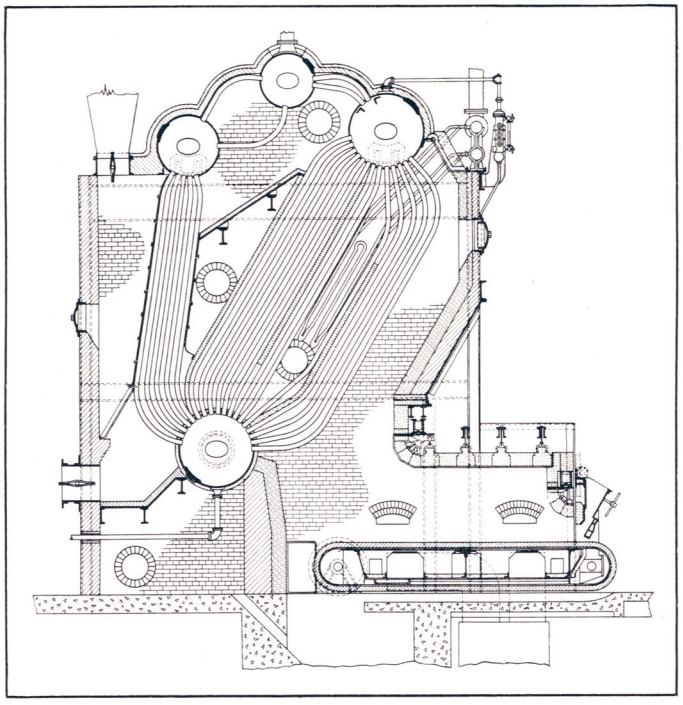
(g) The use of special heat-resisting metal shields to protect the observation ports against radiant heat.

(h) The use of pre-heated air, drawn from the setting ducts and passed to the burners for the primary air.

In appearance this equipment is quite similar to that shown on pages 11 and 22, except that in the latter the combustion air passing through the setting walls is taken in at air registers opposite horizontal ducts, instead of entering vertical ducts at a point below the boiler room floor.

The illustration on this page shows a smaller cross section, four-drum type, arranged for either four or five gas passes. The supporting steel is extremely simple, yet carries out the accepted theory of an outside suspension.

Many of the features of heating surface



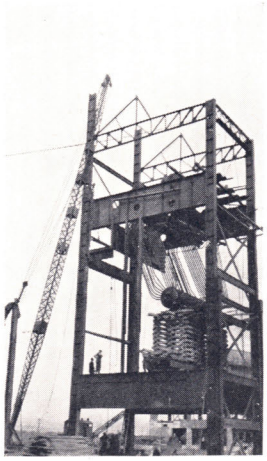
Four-Pass McAleenan Inclined Type Boiler arranged for Chain Grate Stoker

arrangement just described are present in this smaller unit but it is quite impossible in the lesser sizes, adapted as they very frequently are for standard stokers, to obtain the latitude necessary to secure maximum heat absorption.

In this boiler the tubes are preferably of the same size throughout and are spaced with the ligament generally used with all standard makes of inclined boilers. The setting dimensions may be changed to accommodate any stoker or superheater desired by the purchaser, and the furnace width may be varied to permit normal ratings up to twelve or fifteen thousand square feet of heating surface.

For service where only moderate overloads are expected and where good water conditions prevail, if low first cost is important, the steam drum may be omitted by carrying the top row of nipples to the rear top drum and providing a steam nozzle at this point. These changes accomplish an appreciable saving in both boiler and setting, and in no way alter the economy of operation. When this is done, the removal of the steam drum and its possible effect on the quality of the steam is largely offset by the superheating action of the gases as they emerge from the third gas pass, impinging on the top steam tubes.

Oct. 3, 1923



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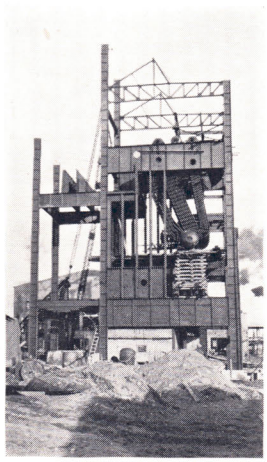

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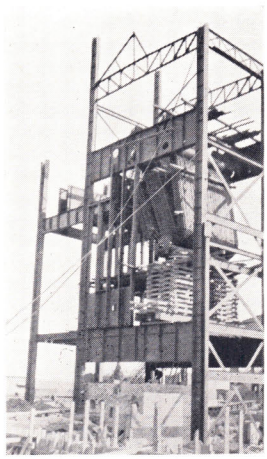

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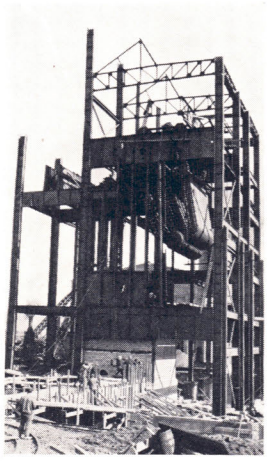

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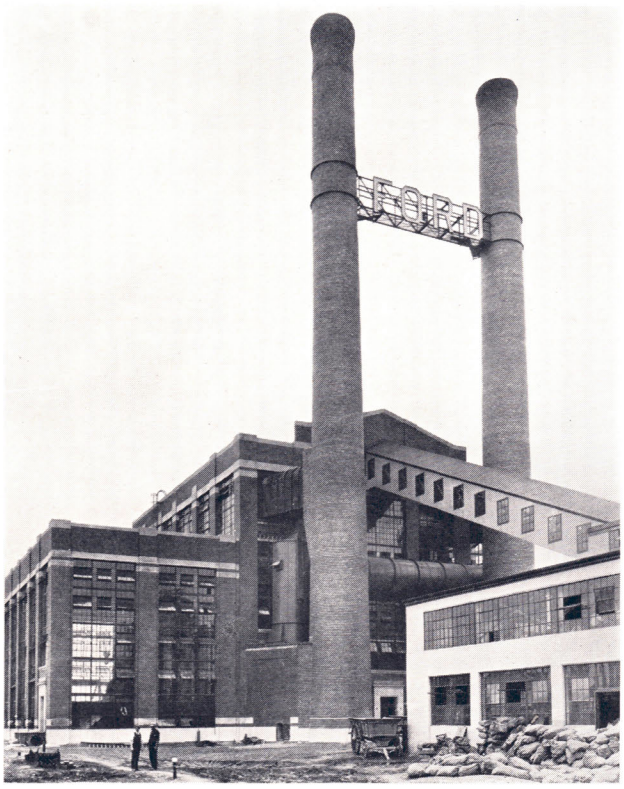
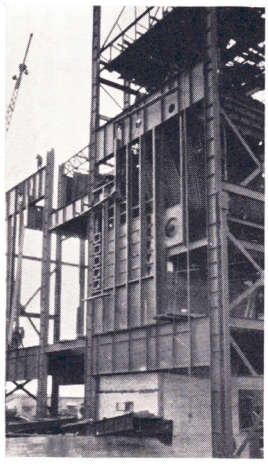
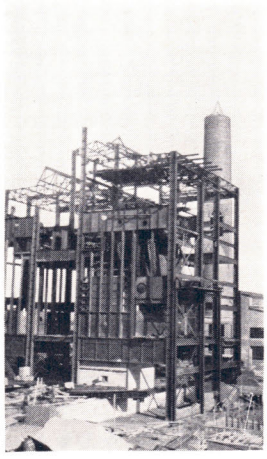


No. 1 Boiler under steam, Dec. 1, 1923

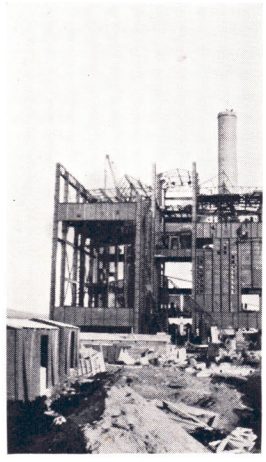


Nov. 2, 1923



Nov. 6, 1923

Photographic record of field progress.
Installation of Boilers, Ford Motor Company,
No. 2 Power House,
Iron Mountain, Michigan.



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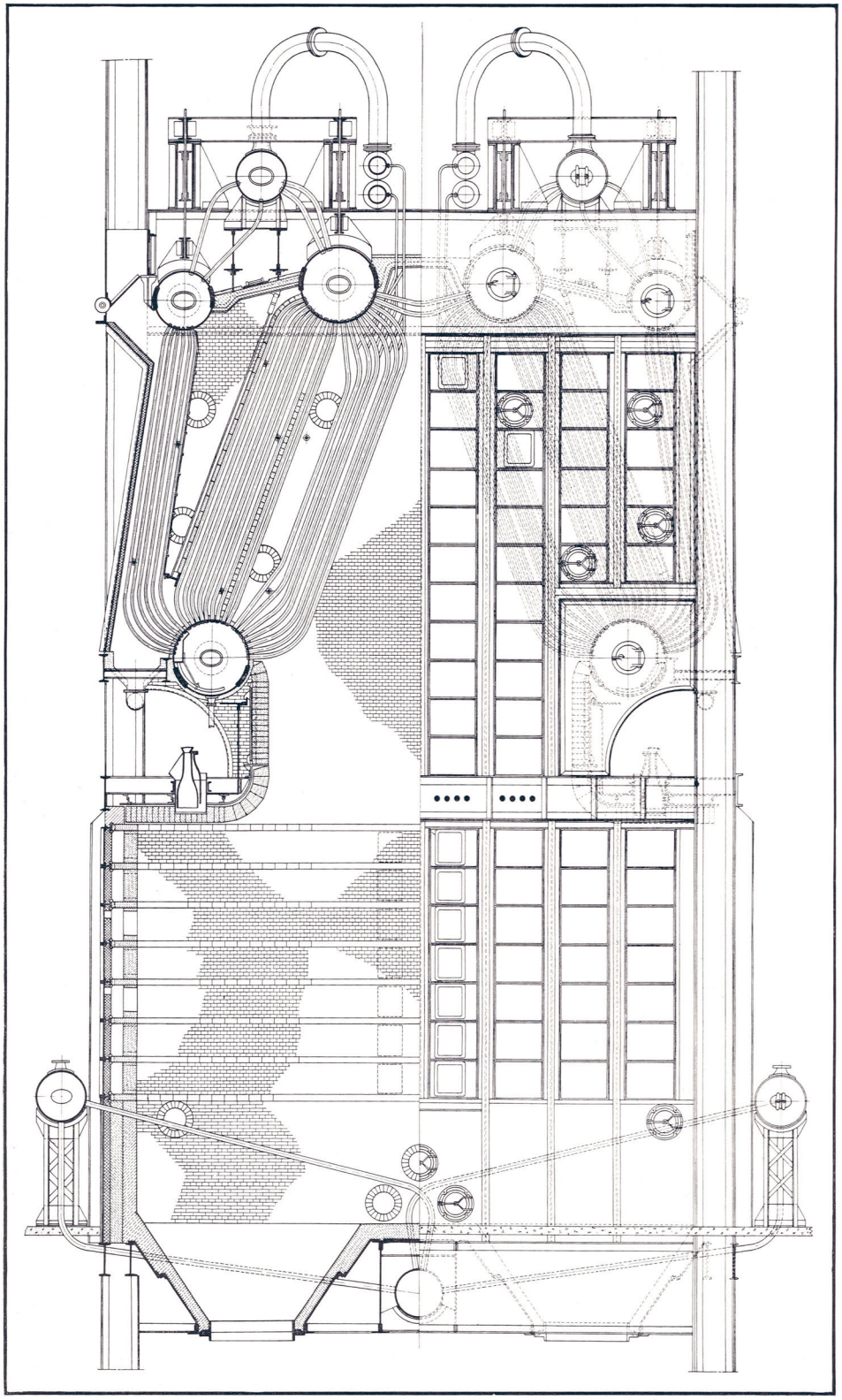


McAleenan Multi-Drum Inclined Type Boiler, 5000 normal rated horsepower

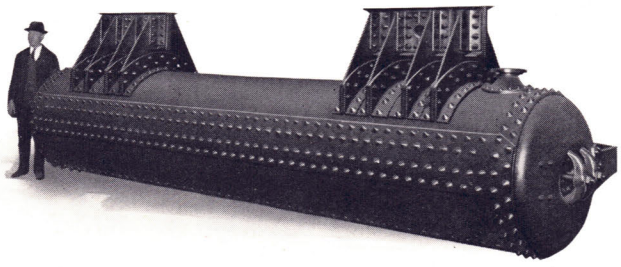
DATA

Working pressure, 370 pounds
Heating surface, 50,000 square feet
Superheat, 200 degrees
Floor space, Column centers 36′ x 36′
Weight of boiler water and baffles, 1,100,000 pounds
Boiler Supported by { 16—100,000 lb. sub-hangers / 8—200,000 lb. main hangers

Steam nozzles, 4—12″
Main drums, 54″ I.D.
Feed drums, 42″ I.D.
Steam drums, 36″ I.D.
Furnace volume above water screen, 29,178 cu. ft.
Number pulverized fuel burners, 30

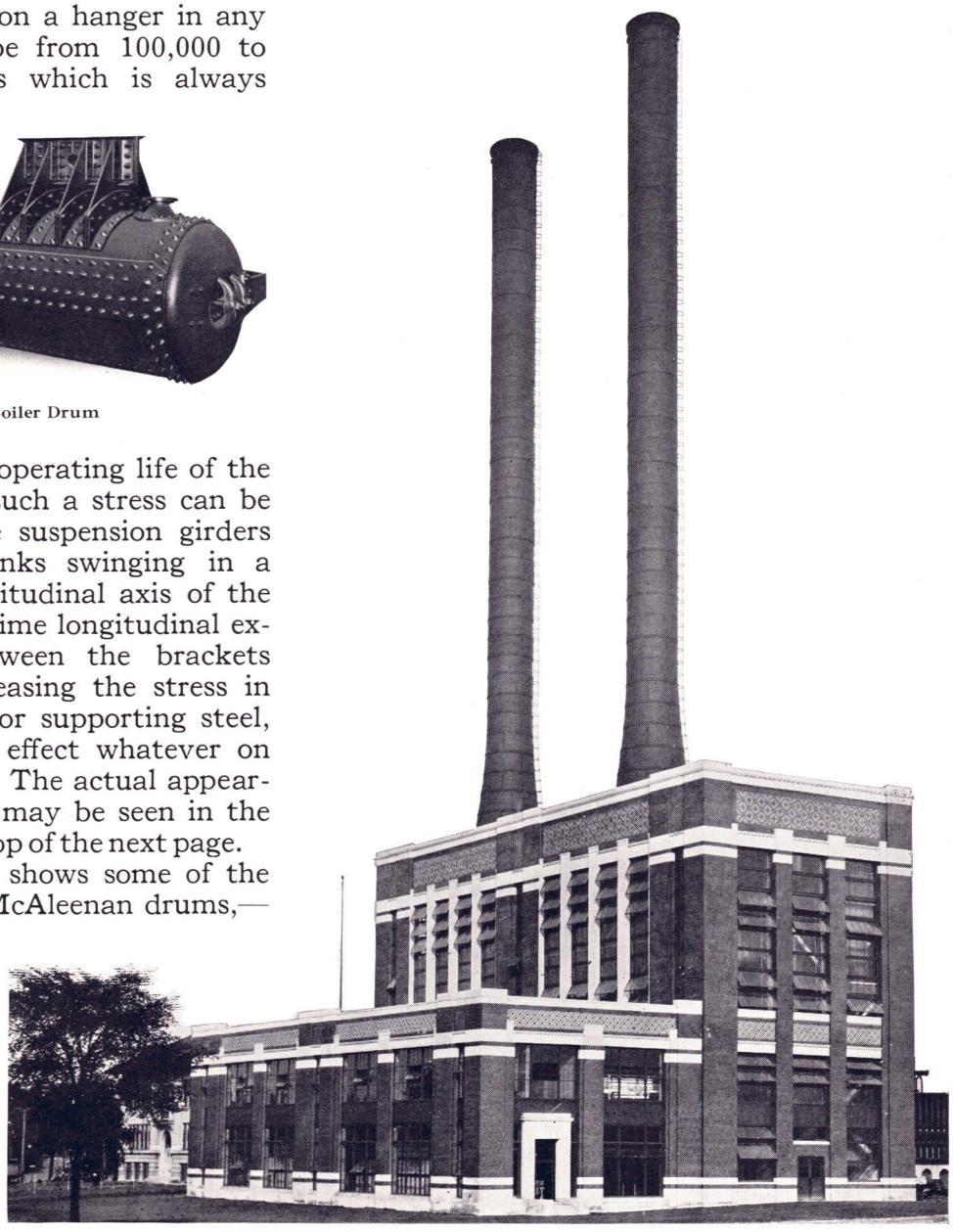
FOR USE with the larger McAleenan boilers and in fact for many cases where moderate sizes are used, the wrought steel hanger bracket, shown with the drum on this page, offers the safest, most compact and flexible suspension detail yet devised. Each component part of this bracket can be satisfactorily investigated for rivet stress, bending and shear, and the value of the metal itself can be predetermined far more closely than is the case with cast brackets.

The concentrated load on a hanger in any large boiler may easily be from 100,000 to 150,000 pounds, a stress which is always present during the entire operating life of the unit. With this hanger such a stress can be safely transmitted to the suspension girders through pin-connected links swinging in a plane parallel to the longitudinal axis of the drum, while at the same time longitudinal expansion takes place between the brackets without appreciably increasing the stress in either the bracket, links or supporting steel, and without having any effect whatever on the brick enclosing walls. The actual appearance of this arrangement may be seen in the illustration, Fig. 1, at the top of the next page.



Typical McAleenan Boiler Drum

The photograph above shows some of the other salient features of McAleenan drums,—double-riveted head seams for high pressure work, swinging manhole plates, and forged steel nozzles. The butt detail is preferably that shown—the shell plates secured by equal width straps,—although, if desired by the purchaser, other standard riveted joints will be furnished. The number of butt joints to a drum is largely dependent on the required size of the shell plate and its thickness. The shorter drums for moderate pressures generally are successfully made with one butt joint, but in the larger sizes much more accurate work is secured by the use of two joints. In drilling the tube holes great care is exercised to preserve the designed width of bridge between the tubes



Power Plant containing Boilers shown on opposite page

and to secure smooth, round holes which enter the cylinder on true radial lines.

The side view of the boiler on this page, Fig. 2, shows a possibility in mounting large boilers, when the building steel provides the supporting structure, that has received little attention in the past. In the case in point a very deep web was used in the main supporting girder, at a small additional expense for this particular member, making it extremely effective as a building brace. Largely by virtue of this depth it was possible to omit diagonal bracing between the boiler columns opposite the tube nest and furnace walls, leaving these areas entirely free for locating soot blowers, access doors, and other openings, without regard to structural interferences.

These views also illustrate a full steel jacketed construction, a portion of which can, of course, be omitted without serious operating losses. It is essential that a furnace of the type shown should be steel encased for structural reasons, but all portions of the boiler other than the air-cooled furnace wall areas could be successfully constructed with the brick exposed. The full steel jacket adds somewhat to the cost of installation, but is perhaps justified by appearance.

The ash tunnel, Fig. 3, is an excellent example of the cleanliness it is possible to maintain with an installation of this character. Given a fair quality of coal, only a relatively small amount of ash is gathered in the ash pits. This is usually of a very fine consistency, and is easily removable through properly constructed gates or by a more elaborate system of sluicing.

The boilers shown on this page are located in the Walkerville plant of the Ford Motor Co. of Canada, Ltd. They operate at 250 pounds pressure and 200 degrees of superheat and are fired with pulverized fuel. Every care was exercised in the design of this station to provide the most efficient equipment possible and to install it in the most approved manner. This plant, while actually very compact, gives to the eye, due to its skillful arrangement, an appearance of roominess rarely encountered in similar layouts. In the boiler room this was partially accomplished by grouping the boilers, making every other aisle a wide working space. Floor space was further economized and room at the rear provided by undercut settings.

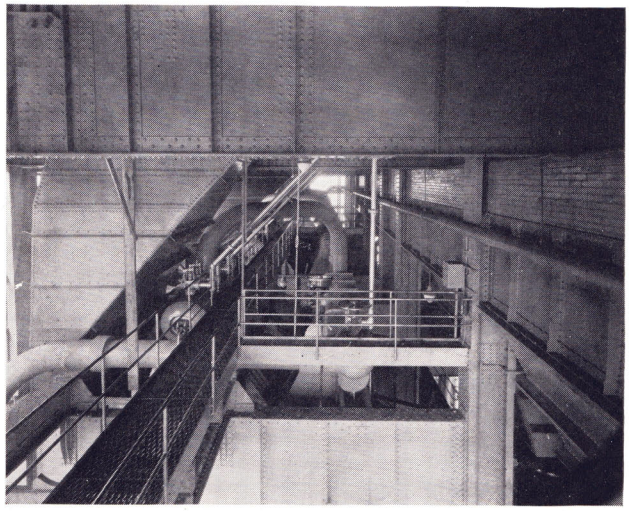


Figure 1

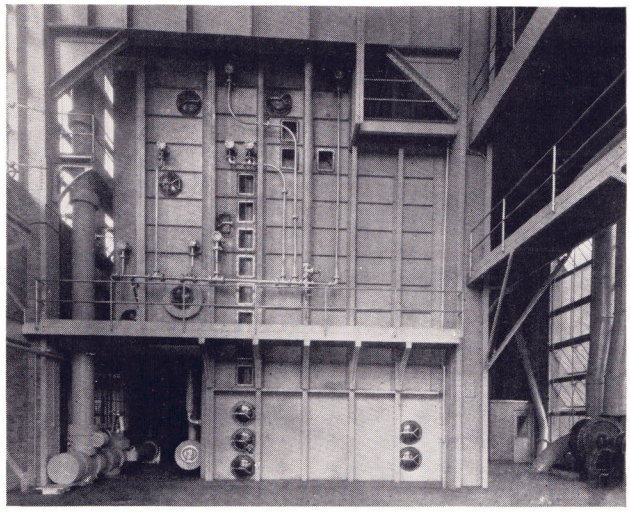


Figure 2

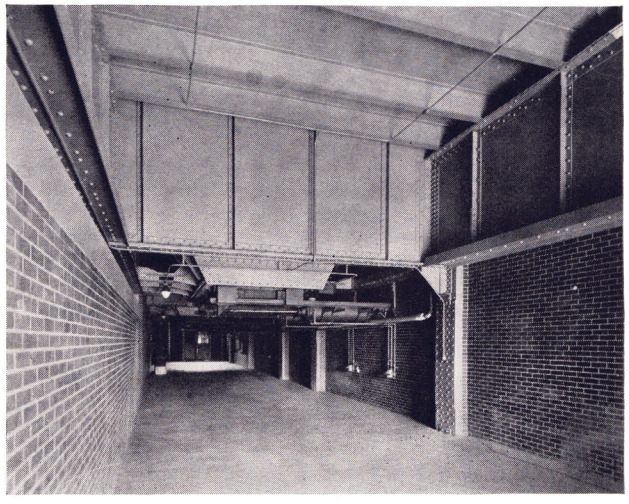
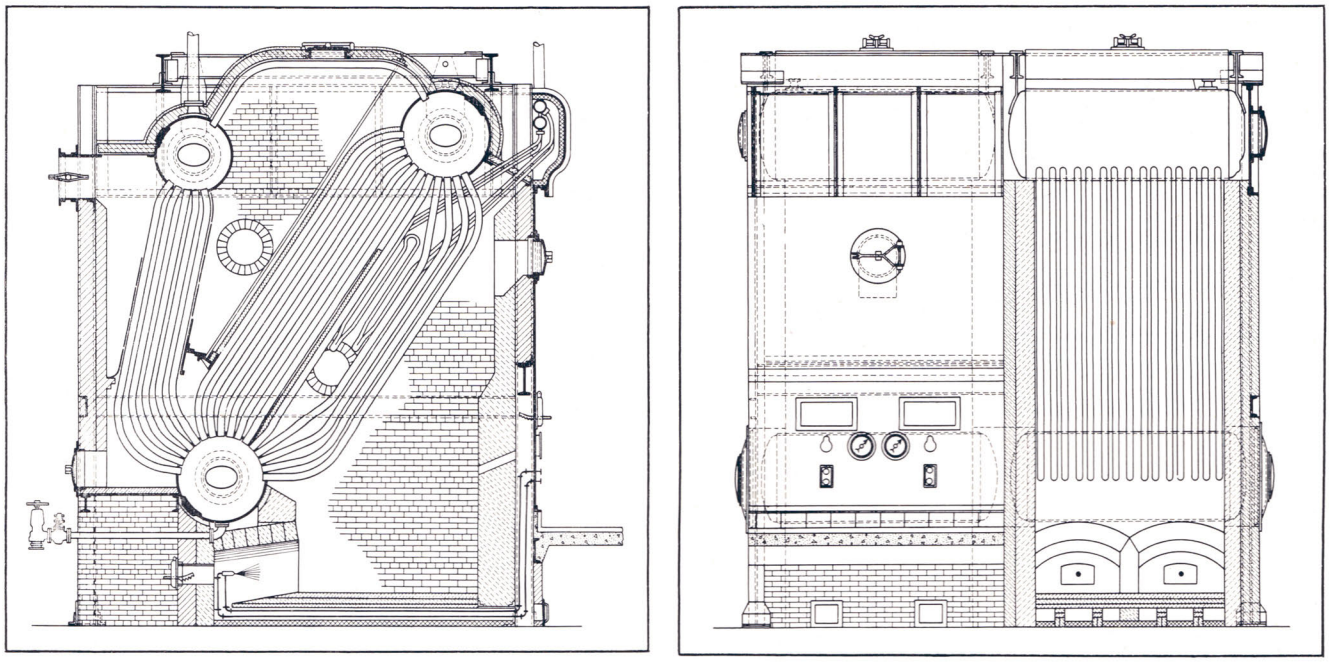


Figure 3



Three-Drum McAleenan Inclined Type Boiler arranged for oil firing

Small Boilers for Industrial Plants

THIS class generally includes units up to 750 Hp. fired by hand, oil, stoker, or, as in not a few recent installations, by the unit system of pulverized fuel. Boilers in this class usually average about two hundred pounds pressure and must possess the utmost reliability, for it frequently occurs that the operation of the entire boiler plant is necessary at certain intervals to provide the steam required.

They are set in a variety of ways both as single and battery settings and often are limited by space conditions. A single setting is always preferable, but a saving in installation cost and a small amount of available space, many times influence the purchaser to install a battery arrangement. To meet this condition The McAleenan Corporation has designed a battery suspension which is in all ways similar to a single suspension, but is worked out to support two boilers with a party wall between.

Boilers in this general classification may or may not be fitted with superheaters. For cases where superheat is desirable, the arrangement shown on this page is very suitable, because it allows ready access to the superheater headers. Should trouble develop with any one of the superheater elements, the defective element may be very quickly removed; and if time does not permit full repairs, the header tube holes may be plugged and the boiler immediately put on the line.

A three-drum cross section is illustrated on this page, but boilers of this size can equally well be provided with a steam drum. As a class, however, they do not operate at excessive ratings, and in many cases they are used primarily for heating work or process steam, which further reduces the desirability of a separate steam drum.

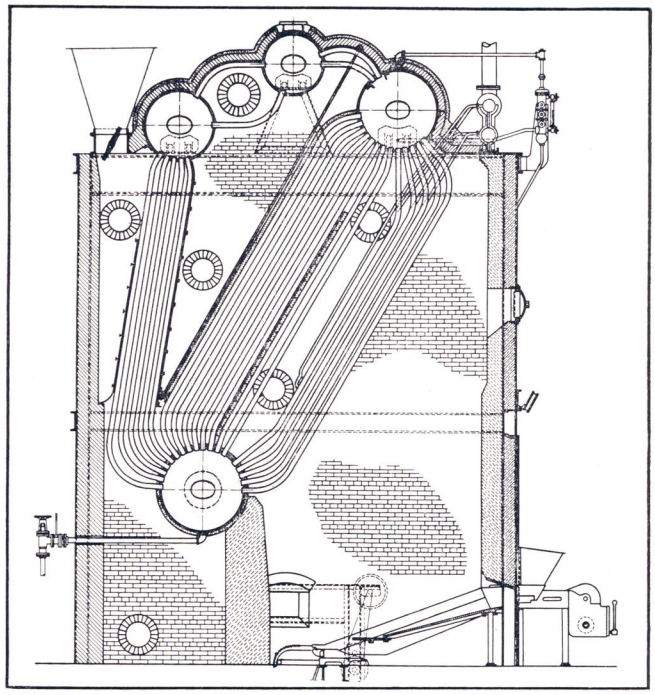
The cross section shown at the top of page 13 is an extremely economical boiler both in space required and in first cost. It is primarily adapted for use with the multiple retort stoker or for use with the unit system of pulverized fuel. It contains about five hundred and ninety square feet of heating surface per running foot of furnace width, and in depth and height does not exceed other standard makes designed for similar conditions. This boiler is well proportioned for four or five gas passes

and is adapted to many different variations in suspension and furnace arrangements for different forms of firing.

In all McAleenan boilers, from the smallest to the largest, the same casting details are used. The setting access doors are of heavy construction, circular in form, as an aid in securing good brick construction, and seat on asbestos gaskets. For the hotter parts of the setting still heavier brick-lined doors are used, but of the same general form and appearance. The baffle and furnace castings are particularly rugged and invariably are designed in short lengths and are supported in a manner which makes possible their easy removal.

In the smallest units it is difficult and seldom desirable to arrange the gas travel for more than three passes, but for boilers in excess of 400 Hp. any of the baffle arrangements previously illustrated can be used. A four- or five-pass arrangement, however, necessitates resting two baffle walls on the lower drum; and whenever such a detail is used, special provision must be made to remove soot and ash from the pocket formed by the baffles.

A boiler damper, even in a relatively small setting may easily be a source of constant annoyance. The dampers furnished with this equipment are provided with shaft supports at sufficiently frequent intervals to prevent sagging and are built with the smallest allowable clearances. If required by the damper control mechanism, special roller bearings can be supplied.

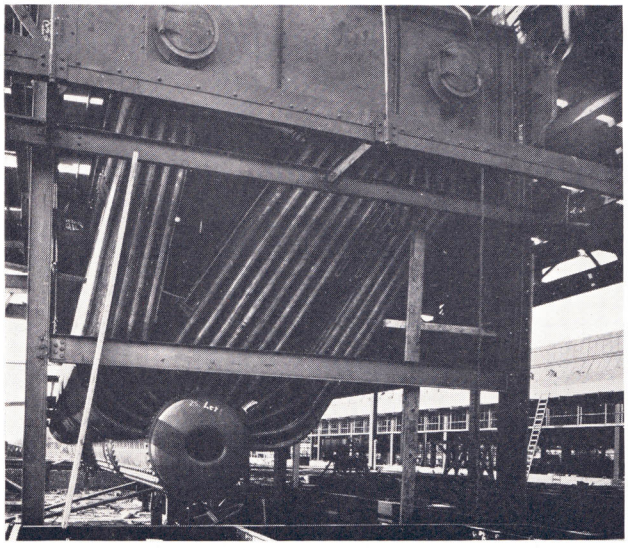


McAleenan Inclined Type Boiler arranged for Multiple Retort Stoker

Full steel fronts are a part of our standard design except in cases where special settings are required in which the front is more properly a portion of the setting itself. A steel front can be made equal in appearance to a cast iron front; and from the standpoint of utility, and of weight in the larger sizes, it is far more desirable.

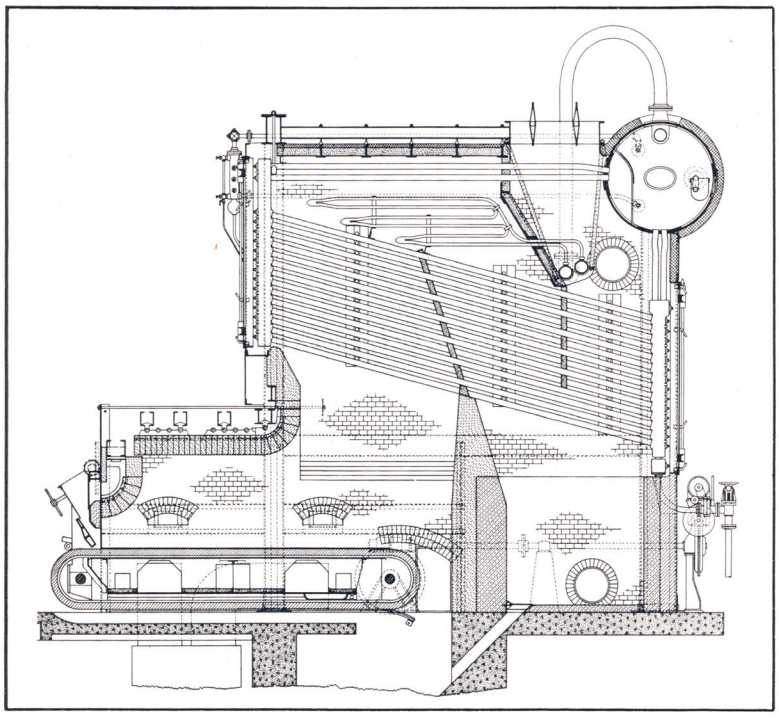
In industrial work individual stacks frequently are mounted over each boiler, an arrangement which may require some additional provisions in the boiler suspension to carry the stack load. In most cases the McAleenan suspension is sufficiently heavy to withstand such a load, but any unusual conditions may be provided for if the stack loading is known before the boiler supports are fabricated.

Valves and fittings supplied with McAleenan boilers usually are optional with the purchaser. With some valves, particularly the blow-off combination, there is a wide range in price due to difference in cost between iron and steel bodies and to the widely varying specifications of different manufacturers. The safety valves supplied also may be selected by the purchaser from any of the standard makes approved by the A. S. M. E. Code.

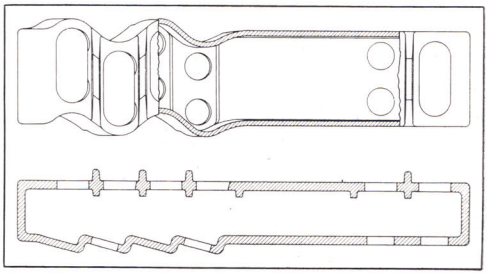


Photograph of Boiler shown in design drawing on opposite page

Essential Details of the McAleenan Horizontal Boiler



McAleenan Horizontal Type Boiler arranged for Forced Draft Chain Grate Stoker

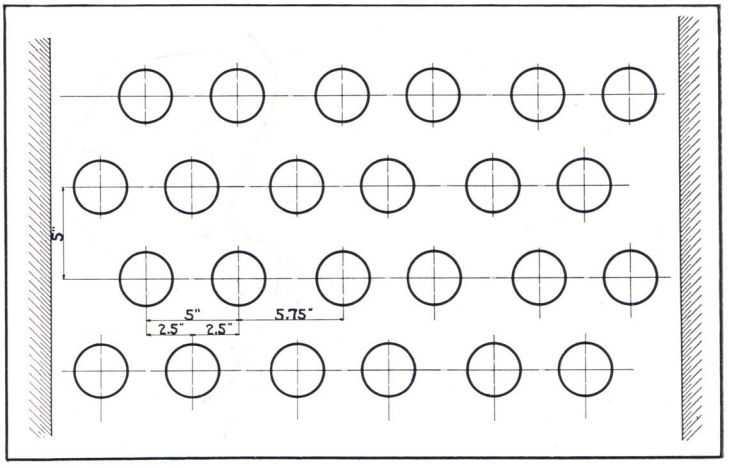


Sectional Header

THE headers are castings of high-grade electric furnace steel properly annealed to refine the grain and remove strains. In a wrought steel header it would be extremely difficult, if not impossible, to secure the desirable bridge construction between handholes, which eliminates any possibility of flexure. This detail coupled with the equally desirable ones of double tube handhole plates and large water circulating areas, offset any doubtful advantage of wrought steel over the material used in these headers. Pressure tests, fifty per cent in excess of working pressure, applied to the headers before and after the tubes are expanded into them, prove their strength and water tightness. Each handhole affords access to two tubes and is closed by a drop-forged steel cover plate seating on a thin gasket between milled surfaces.

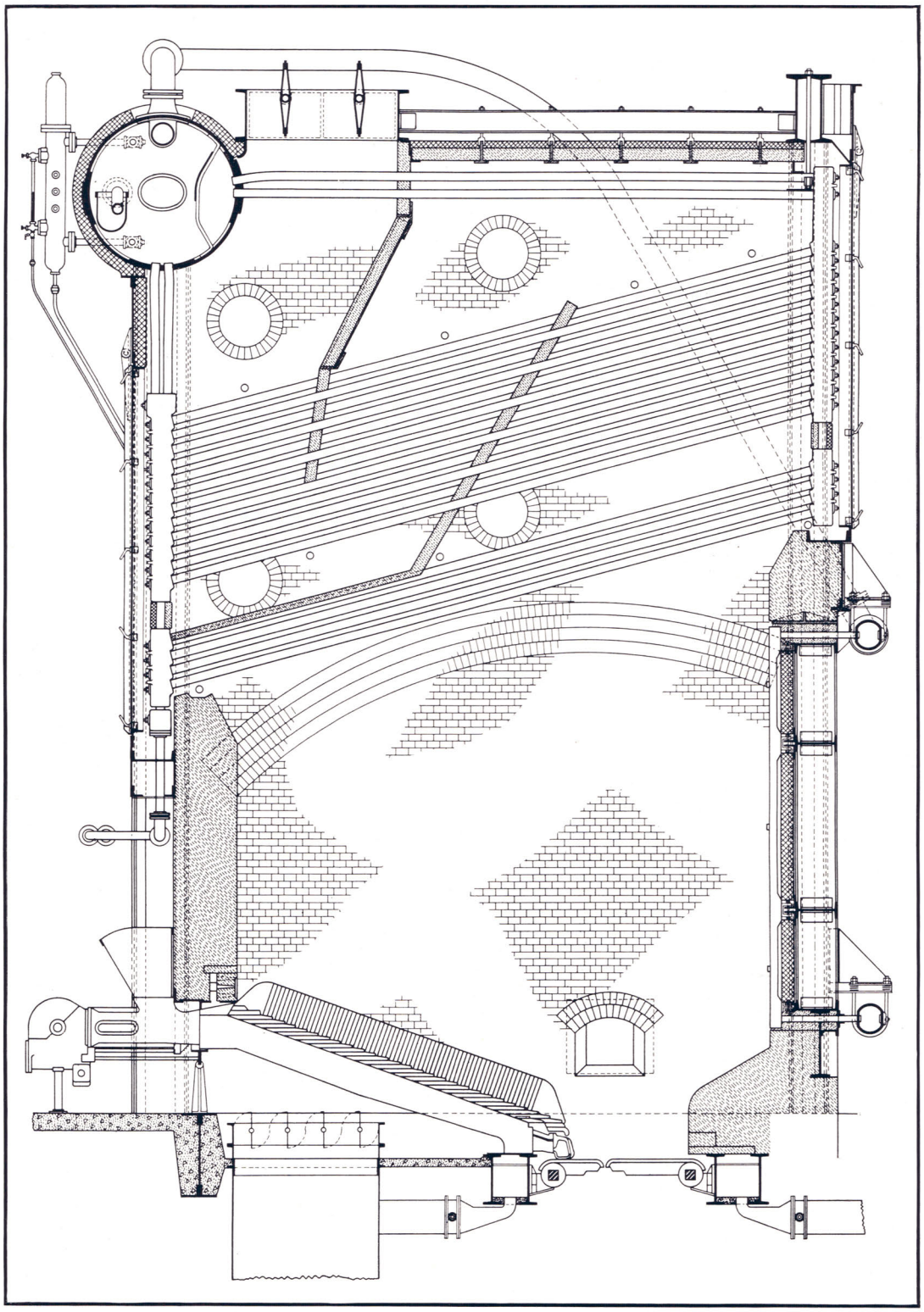
The cross drum is of riveted steel plate construction with double butt-strapped longitudinal joints. The horizontal circulating tubes enter the drum through one of these joints, the butt straps serving as reinforcement at this point. An inside reinforcing plate also is provided where the tubes connecting the rear headers enter the drum. Manholes and flanged fittings of standard design, suitable for the boiler size, are supplied on the drums. The mud drum is of the same material as the headers, equipped with handholes and connections for blow-off.

The standard tube for this boiler is 3-inch diameter hot-drawn seamless steel of proper gauge for the specified working pressure. In comparison with larger tubes, it has been found that this size offers the advantage of more rapid and flexible steaming possibilities due to the proportionately larger heating surface per unit of water content.

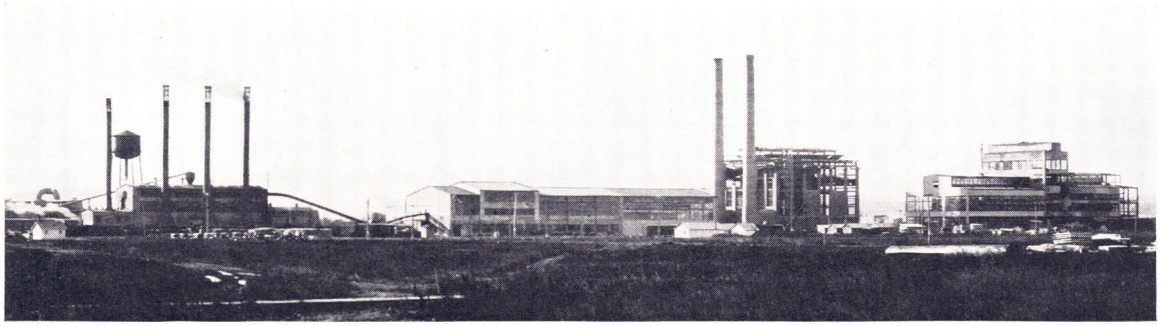


Tube Layout

The tubes are spaced in straight horizontal and staggered vertical rows in such a way as to extract the largest possible amount of heat from the products of combustion. The diagonal lanes in two directions facilitate cleaning and baffle renewal, and simplify the removal of slag.



McAleenan Horizontal Type Boiler equipped with Foster Radiant Superheater and arranged for Multiple Retort Stoker



BOILER SETTINGS

THE McAleenan Corporation offers an exceptional service in the complete installation of large and complicated boiler settings and furnaces. This service includes the detail design of all metal and refractory parts, the fabrication of the steel work and cast iron members, and the entire erection, even to the smallest item, all under one responsibility.

This service is not limited to the setting of boilers of our own manufacture, but has been extended to cover most of the well-known makes. In short, we have complete engineering, shop and field facilities, reinforced by an extended experience in the actual construction of such work. In structures where air preheaters or economizers are installed, the entire duct system, either of riveted or welded construction, may be included, together with ash pit steel, superheater casings and walkways.

Such a service reconciles widely varying classes of work, anticipates almost inevitable gaps, which would occur if divided responsibility existed, co-ordinates the manufacture and shipment of materials and enables quick, orderly and economical construction of the work. We will also undertake the testing of materials, furnishing comparative data on the various refractories and insulation under consideration.

It frequently happens that the closing in of the first one or two boilers of a new plant must be accomplished in the shortest possible space of time. The first of the two McAleenan boilers, shown at the bottom of page 18, was completely set in sixty-six working days from the assigning of the work. It involved the preparation of the detail drawings, the fabrication of all materials, and their complete erection at a point requiring a shipping time of approximately two weeks. Nearly six weeks of the total time was required for the burning of the special tile; and to accomplish the delivery date it was essential for all the furnace steel to be in position before the arrival of the brick materials at the site.

The furnaces in question are air cooled, full steel jacketed and carefully insulated to prevent radiation. Each contains a combustion space of approximately 6,138 cubic feet and required nearly one hundred tons of steel and cast iron parts, together with almost four hundred and fifty tons of refractory and insulating materials, in its construction.

The line drawing on page 19 shows one of four 2250 Hp. B & W boilers equipped by The McAleenan Corporation with furnaces, steel jackets, ash pit linings, and air duct systems, at the plant of The Ohio River Edison Company, Toronto, Ohio. These are also "Lopulco" air-cooled furnaces; and in this case, in addition to bottom water screens, the settings are further provided with side and rear water walls or cooling tubes to insure the greatest possible setting life and reliability.

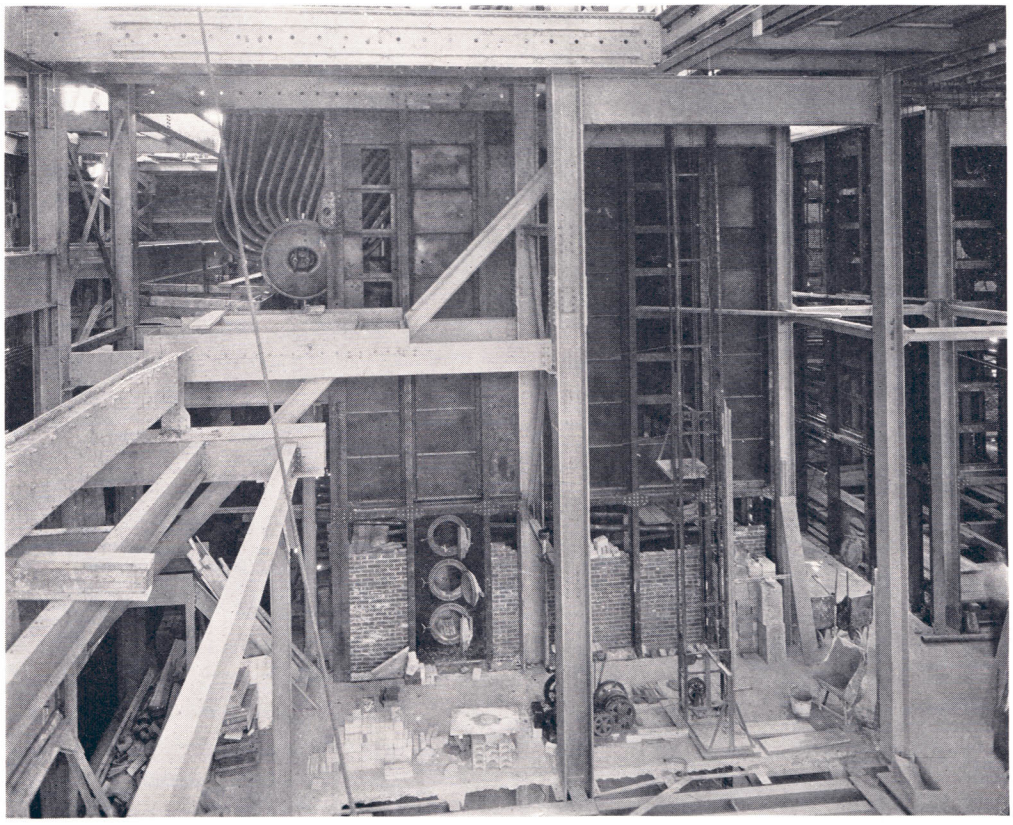
The development of steel casings for all forms of boiler furnace work has led to the almost exclusive use of the outside bolted type.

With this casing both the heads and nuts of the fastening bolts are exposed, making the removal of any panel a simple matter. Such a casing may be made impervious to air leaks at the joints, and the slight additional expense involved is much more than compensated for in the reduced labor cost of lining the furnace. This can be accounted for by the ease with which material may be passed into the furnace through any convenient point.

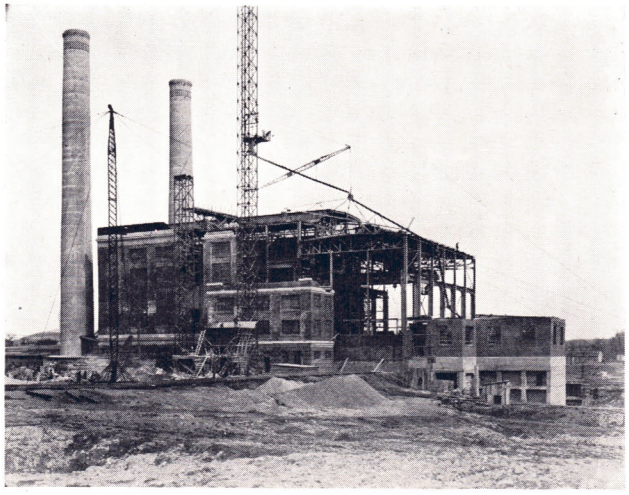
The furnace interior, shown on page 18, gives an excellent idea of the inside appearance of the construction of an air-cooled pulverized fuel setting. This furnace shows clearly the courses of holding tile which define the air ducts between the interior furnace lining and the outer insulated casing, together with the air admission ports in the front wall and the burner openings in the arch above. The picture is taken from below the water screen, looking vertically up. It includes, besides the front and side walls of the furnace, the front bank of boiler tubes.

While the work mentioned here shows principally construction of larger boilers and more complicated forms of settings, The McAleenan Corporation is prepared to undertake the setting of stoker-fired equipment for both large and small installations and the furnishing and erecting of any metal parts, such as breechings, air ducts and stacks, to complete and make the plant ready for operation.

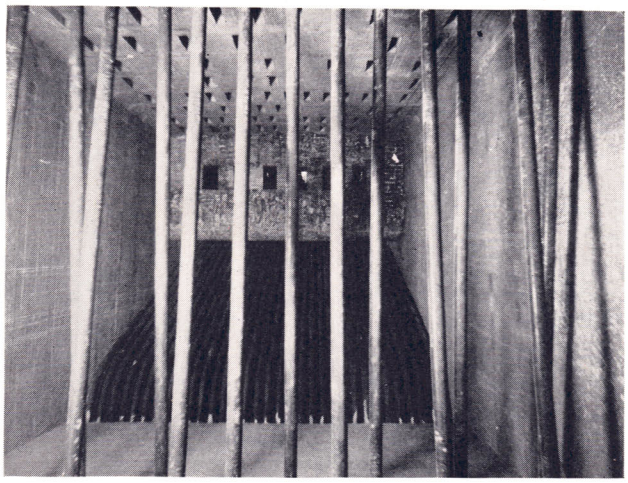
It frequently occurs in existing plants that economical changes can be made by combining two or more small units into one large setting. Such a change may involve a serious boiler suspension study rather than a setting problem. We are, however, prepared to undertake work of this nature, designing and furnishing new suspensions for remade units as well as the completed settings. In a number of actual cases such designs have been completed, and comparatively modern boilers as large as 1500 Hp. were produced by combining three more or less antiquated small boilers with inefficient firing equipment and entirely inadequate furnaces.



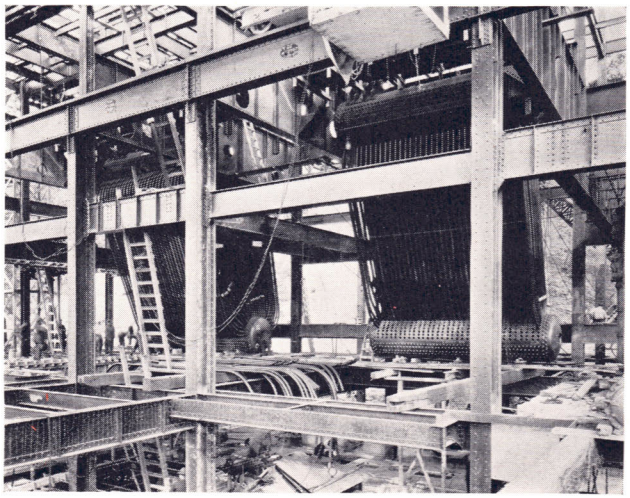
Settings for 1470 Hp. Connelly Boilers in process of construction
Metropolitan Edison Co., Middletown, Pa.



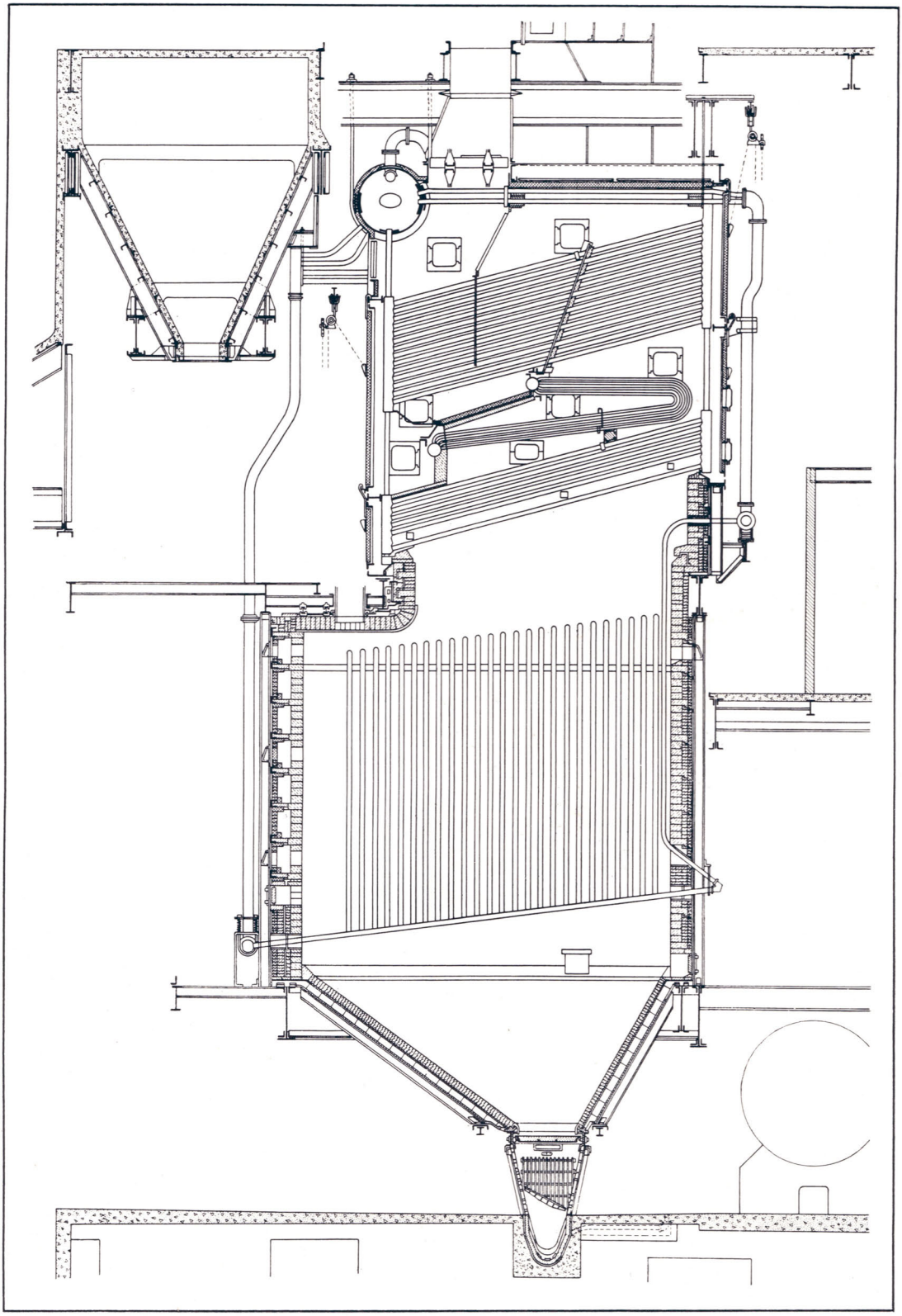
MIDDLETOWN, PA., Plant of Metropolitan Edison Co. Boiler Settings in this plant together with Air Duct work were constructed in their entirety by The McAleenan Corporation.



INTERIOR view of an Air-Cooled Pulverized Fuel Setting, surrounding a McAleenan Inclined Type Boiler. Boilers and Settings were furnished and installed by The McAleenan Corporation.



MCALEENAN Inclined Type Boilers during erection. These units are 1371 Hp. each, designed and equipped for Central Station work. Both Boilers and Settings were completely installed by The McAleenan Corporation.



Line drawing showing "LOPULCO" Furnace for 2250 Hp. B & W Boiler. Furnaces and Air Duct Systems installed by The McAleenan Corporation. Stevens and Wood, Designing and Constructing Plant Engineers

Boilers for the Utilization of Waste Heat

ON page 21 are shown the principal features of the McAleenan vertical waste heat boiler. This boiler is of the single pass, high velocity, fire tube type, the design taking into consideration the important counter-flow action between the water and heat-laden gases.

The tubes in this boiler are of small diameter and so grouped as to produce positive circulation of the water by rising currents following the vertical axis of the boiler and falling currents along the entire outer shell. Provision also is made in the design for attaching outside circulating tubes if conditions warrant their use.

One of the most desirable features of this design is accomplished by the structural form of the top of the boiler. The upper shell course is tapered outwardly providing an extremely large steam relieving area and steam storage dome. In fact these two latter items can be considered, in the design given, as approximately equal in capacity to that which would be expected in an average 500 Hp. water tube boiler. There is one difference, however, which is that the waste heat boiler shown contains approximately 5700 square feet of heating surface; and unless supplied with exceptionally high temperature gas, would not be expected to generate much over 600 Hp., while the water tube boiler with which the relieving surface is compared could doubtless generate, when direct fired, at least 1500 Hp.

The top construction further provides that all metal parts below the bottom of the dome lining, which are subjected to heat, be continually and completely submerged. Such a condition allows starting of the boiler without the necessity of relying on steam or vapor to cool the metal above the water line.

The top of the boiler is fitted with a hood of convenient form to provide connection for the up-comer or duct which leads the waste gases from the source of supply. This duct may house the superheater or, if the installation conditions offer a more convenient point of application not too remote from the boiler, it may be installed elsewhere.

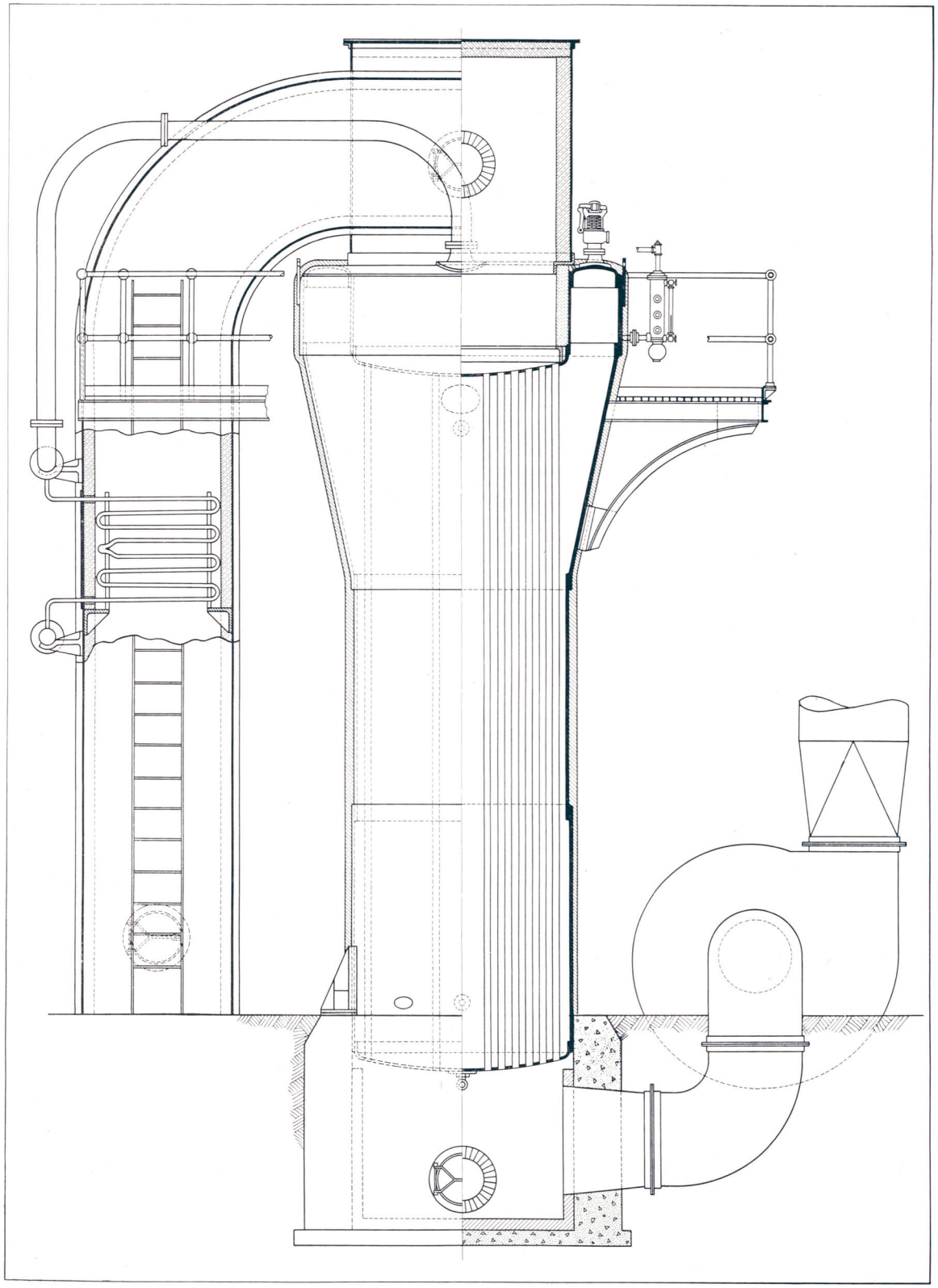
The boiler is supported on a three-lug suspension over a circular pit with which the exhaust fan is connected. The space occupied by the boiler is practically a circle equal to the shell diameter plus the necessary space which must be provided for the fan and its drive.

Feed connections are supplied at levels slightly below the water level and at the proper distance above the blow off, entering either directly into the shell or the outside water legs, as the case may be. In the standard equipment provision is made to automatically change the point of feed, depending on the temperature of the water in the bottom of the boiler and the variations in temperature of the incoming feed water.

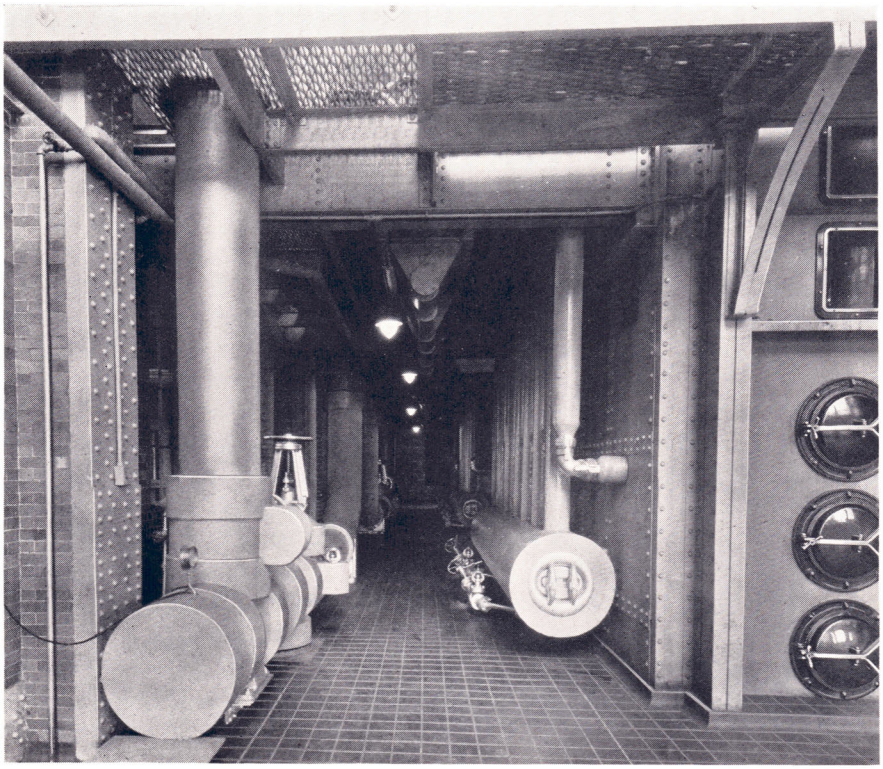
Up to 6000 square feet of heating surface, the boiler can be satisfactorily constructed for a working pressure of 250 pounds per square inch, and in the smaller sizes, with lesser diameter of shell, for correspondingly higher working pressures.

The advantages which may be rightfully claimed for this boiler are as follows:

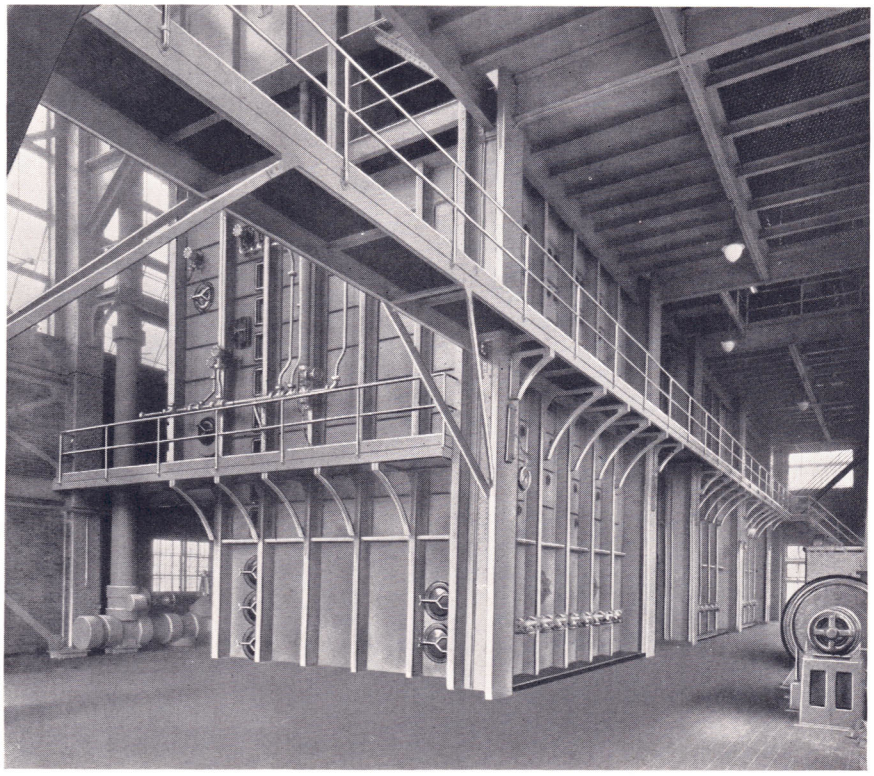
1. Absolute prevention of air infiltration.
2. Extremely small floor space requirement.
3. Large liberating area and steam space.
4. Large water storage capacity.
5. Simple provision for preventing heat loss between the supply duct and the fan.
6. High velocity gas travel through small tubes.
7. Low draft loss.
8. A straight gas flow with the attendant cleanliness of the heating surface.
9. Conditions most conducive for high heat transfer.
10. Convenient superheater application.
11. Installation possibilities in the open.
12. Opportunity for auxiliary direct firing.
13. Convenient gas duct arrangement.
14. A size and pressure range to fit practically any industrial unit generating waste gases.



Design drawing showing McAleenan Waste Heat Boiler; heating surface, 5700 sq. ft.; pressure, 250 lbs.; superheat, 100 degrees



McAleenan
Equipped
Boiler Room



Another View
McAleenan Equipped
Boiler Room

PARTIAL LIST OF FURNACE WIDTHS AND RATINGS
McALEENAN WATER TUBE BOILERS
HORIZONTAL SECTIONAL HEADER CROSS DRUM TYPE

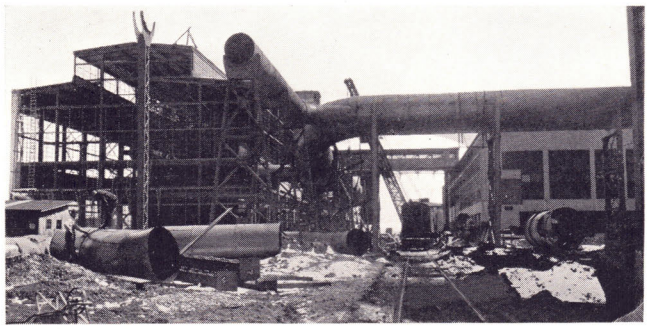
Tubes High		10			12			14			16		18		20	22
Dimension "A"		5′-11 7/16″			6′-9 13/16″			7′-8 3/16″			8′-6 1/2″		Varies			
Tubes Length		16′-0″	18′-0″	20′-0″	16′-0″	18′-0″	20′-0″	16′-0″	18′-0″	20′-0″	18′-0″	20′-0″	18′-0″	20′-0″	20′-0″	20′-0″
Setting Length		17′-6 3/4″	19′-6″	21′-5″	17′-6 3/4″	19′-6″	21′-5″	17′-6 3/4″	19′-6″	21′-5″	19′-6″	21′-5″	19′-6″	21′-5″	21′-5′	21′-5″
Tubes Wide	Furnace Width	HORSEPOWER RATINGS														
10	4′- 8″	143	161	179	168	189	210	193	217	242						
12	5′- 6 3/4″	171	193	214	201	227	252	231	261	290	294	328				
14	6′- 5 1/2″	200	225	250	235	264	294	270	304	338	344	382				
16	7′- 4 1/4″	228	257	286	268	302	336	309	347	386	393	437				
18	8′- 3″	257	289	322	302	340	378	347	391	435	442	491				
20	9′- 1 3/4″	285	321	357	335	378	420	386	434	483	491	546	547	609	671	734
22	10′- 0 1/2″	314	353	393	370	415	462	424	478	531	540	600	602	670	739	808
24	10′-11 1/4″	342	385	429	402	453	504	463	521	580	589	655	657	730	806	881
26	11′-10″	371	417	465	436	491	546	501	565	628	638	710	712	791	873	954
28	12′- 8 3/4″	399	449	500	469	529	588	540	608	676	687	764	766	852	940	1028
30	13′- 7 1/2″	428	482	536	503	567	630	579	651	725	736	819	821	913	1007	1102
32	14′- 6 1/4″	456	514	572	537	604	672	617	695	773	785	873	876	974	1074	1175
34	15′- 5″	485	546	608	570	642	714	656	738	821	834	928	930	1035	1142	1248
36	16′- 3 3/4″	513	578	643	604	680	756	694	782	870	883	983	985	1096	1209	1322
38	17′- 2 1/2″				637	718	798	733	815	918	932	1037	1040	1156	1276	1395
40	18′- 1 1/4″				671	755	840	771	868	966	982	1092	1095	1217	1343	1469
42	19′- 0″				704	793	882	810	912	1014	1031	1146	1149	1278	1410	1542
44	19′-10 3/4″							849	955	1063	1080	1201	1204	1339	1477	1616
46	20′- 9 1/2″							887	998	1111	1129	1255	1259	1400	1544	1689
48	21′- 8 1/4″							926	1042	1159	1178	1310	1313	1461	1612	1762
50	22′- 7″								1085	1208	1227	1365	1368	1522	1679	1836
52	23′- 5 3/4″								1129	1256	1276	1419	1423	1583	1746	1909
54	24′- 4 1/2″								1172	1304	1325	1474	1478	1643	1813	1982
56	25′- 3 1/4″								1216	1353	1374	1528	1532	1704	1880	2056
58	26′- 2″										1423	1583	1587	1765	1947	2130
60	27′- 0 3/4″										1472	1638	1642	1826	2014	2203
62	27′-11 1/2″												1697	1887	2082	2277
64	28′-10 1/4″												1751	1948	2149	2350
66	29′- 9″												1806	2009	2216	2423
68	30′- 7 3/4″														2283	2497

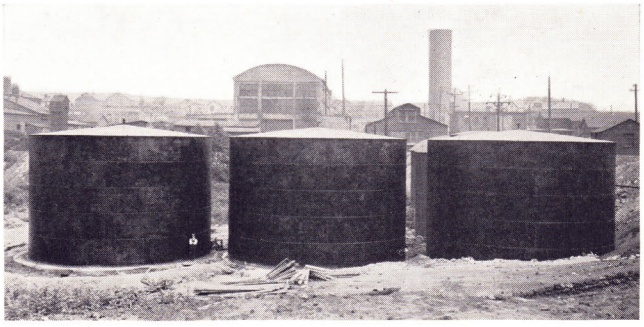
Dimension A = Vertical Distance Bottom of Front Headers to center line of Cross Drum.
Boilers 18, 20 and 22 Tubes High are of Divided Bank Design.

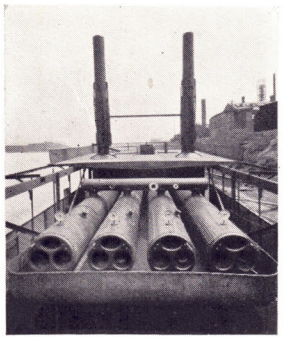
INCLINED TYPE

Class	FC	G	M	R	BO	WBO	Class	FC	G	M	R	BO	WBO
H3	15′-1″	18′-0″	21′-2 1/2″	21′-3″			H3	15′-1″	18′-0″	21′-2 1/2″	21′-3″		
H4		20′-7 1/2″	23′-8″	24′-2″	Variable	Variable	H4		20′-7 1/2″	23′-8″	24′-2″	Variable	Variable
Furnace Width	Horsepower Ratings						Furnace Width	Horsepower Ratings					
6′-0″	225	277	328	354			16′-0″			876	944	1215	2462
6′-6″	244	300	356	383			17′-0″			931	1003	1296	2626
7′-0″	263	323	383	413			18′-0″			985	1062	1369	2774
7′-6″	282	346	411	442			19′-0″			1040	1121	1450	2938
8′-0″	301	369	438	472			20′-0″			1094	1180	1525	3090
8′-6″	320	392	465	501			21′-0″			1149	1239	1591	3224
9′-0″	339	415	492	531	678		22′-0″			1204	1298	1679	3402
9′-6″	358	438	520	560	714		23′-0″			1259	1357	1752	3550
10′-0″	377	461	547	590	750	1520	24′-0″			1313	1416	1833	3714
10′-6″	396	484	575	619	790	1601	25′-0″					1906	3862
11′-0″	415	507	602	649	830	1682	26′-0″					1983	4018
12′-0″	453	553	657	708	920	1864	27′-0″					2060	4174
13′-0″	491	599	711	767	1001	2028	28′-0″					2137	4330
14′-0″			766	826	1060	2148	29′-0″					2214	4486
15′-0″			821	885	1141	2312	30′-0″					2291	4652

H3 = height from center line of Mud Drum to Steam Nozzle for boilers with 3 drums.
H4 = height from center line of Mud Drum to Steam Nozzle for boilers with 4 drums.

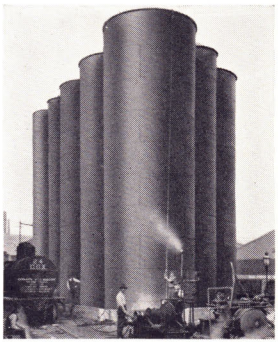


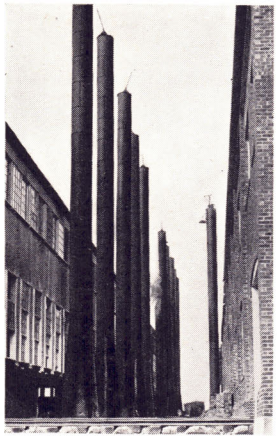




Other Products of THE McALEENAN CORPORATION

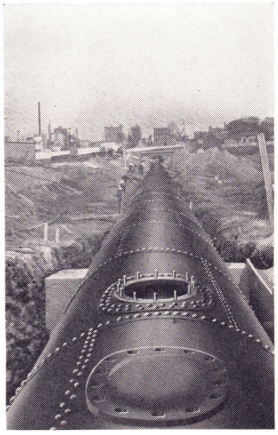
Absorbers (Gas)
Agitators (Steam Jacketed)
Boxes (Annealing)
Breechings (Smoke)
Bunkers (Coal and Ash)
Chimneys (Steel)
Cylinders (Creosoting)
Digesters
Dryers (Chemical and Rotary)
Ducts (Air and Gas)
Evaporators
Flanging
Hoppers (Coal and Ash)
Kettles (Chemical)
Oil Tanks and Stills
Pans (Vacuum)
Penstocks and Riveted Pipe
Receivers (Air and Gas)
Shells (Boiler, Kiln, etc.)
Standpipes
Steel Plate Construction

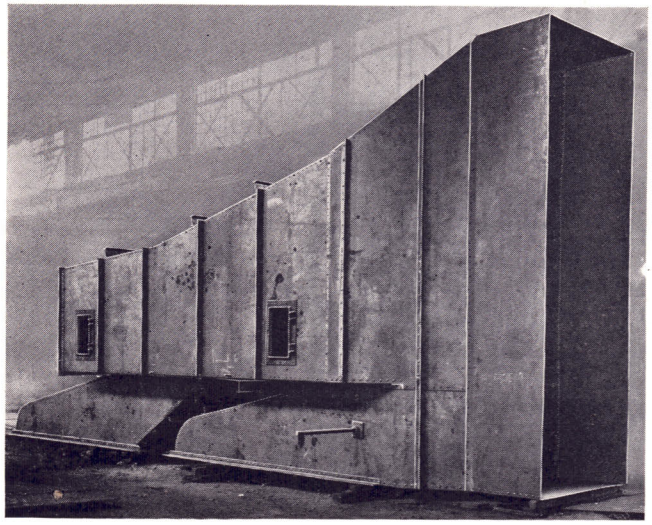


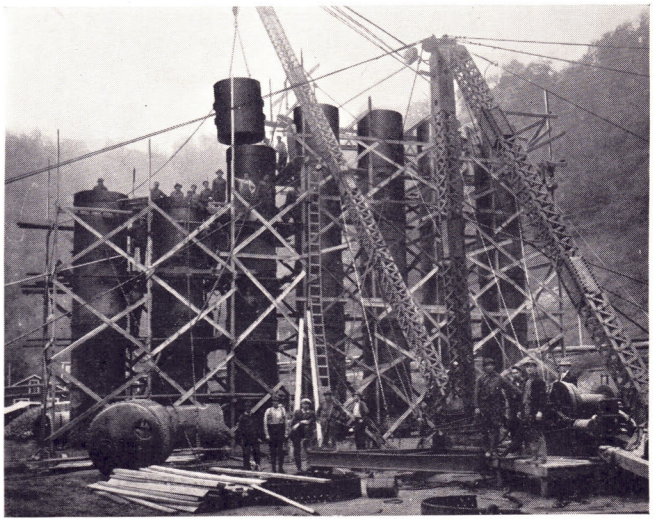


CHEMICAL DIVISION

Waste Pickle Liquor Disposal Systems
Tar Acid Recovery Systems
Chemical Plant Equipment
Chemical Surveys and Reports







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